

Considerations when appropriating water use from the Fox Hills aquifer

Fox Hills aquifer

The Fox Hills-Hell Creek (Fox Hills) aquifer is a shoreline sand depositional feature with lateral (and hydrologic) continuity extending throughout western North Dakota and into Montana, South Dakota, and Wyoming. Recharge to the aquifer occurs over the topographically higher landscape to the southwest, giving the aquifer a flowing pressure head in low-lying areas in west-central North Dakota where the aquifer commonly occurs between 1,000 and 2,000 feet below land surface. Use and leakage of water from the Fox Hills aquifer is causing the pressure head to decline at between about one and three feet per year in flowing-head areas, Figure 1.

Flowing-head wells

More than 500 flowing-head Fox Hills wells have been identified in western North Dakota and eastern Montana. Flowing-head wells allow ranchers to water livestock in remote pastures without the need for an electrical power supply for pumps and tank water heaters. Flowing-head Fox Hills wells were primarily installed in western North Dakota in the second half of the 20th century, mostly as stock wells. More than three-fourths of the flowing head Fox Hills wells are completed using casing two-inches or less in diameter, too small for practical installation of a submersible pump. Most ongoing water extraction from the Fox Hills aquifer in western North Dakota is from flowing-head wells.

The reason for restricting access to the Fox Hills aquifer for large-scale water use is to avoid increasing the rate of aquifer pressure head decline caused by extraction of water from the aquifer. Increasing the rate of pressure head decline shortens the time flowing-head wells will continue to flow. Because of the small diameter construction of most flowing-head Fox Hills wells, once the pressure head declines below land surface the wells will no longer be useable as a water source. While not a water right, the flowing pressure head of Fox Hills wells in low-lying areas of western North Dakota is recognized as a valuable asset to many area ranchers.

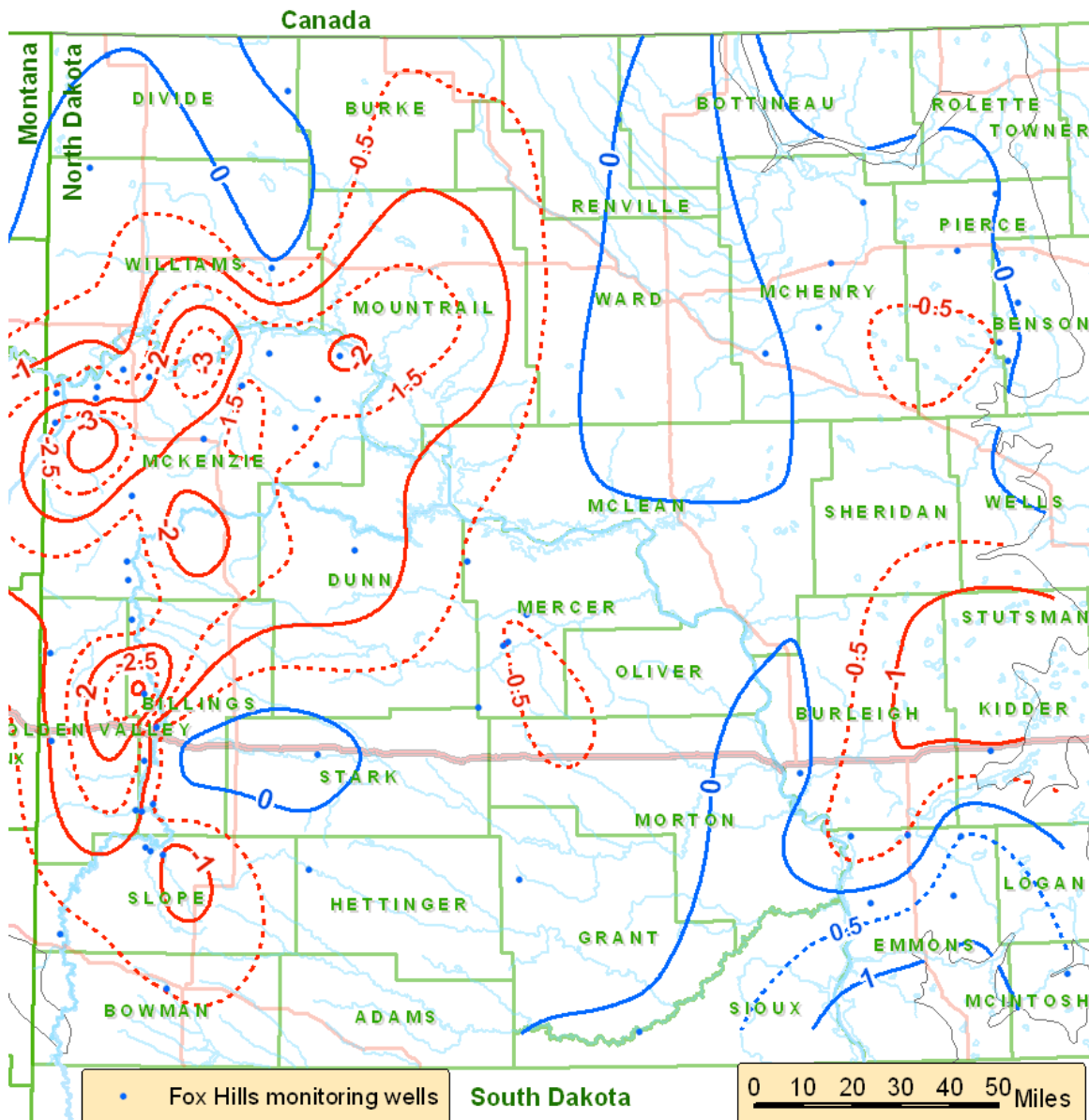


Figure 1. Annual pressure head rate of change in the Fox Hills-Hell Creek aquifer in feet per year, as measured over recent years (Wanek 2009).

Restrictions on the use of Fox Hills' water

Considerations when appropriating industrial water use from the Fox Hills aquifer was the subject of an April 5, 1984 office memo from the director of the Hydrology Division to the State Engineer. A balanced approach of allocating water between the major users was advocated in the memo.

Since that time oil companies seeking water for dilution of brine produced with oil have been directed to install their wells in sediments overlying the Fox Hills aquifer. Water for oil field waterflooding programs have been directed to deep, non-potable water sources. Ethanol and rural water supply projects in western North Dakota were directed to use Lake Sakakawea water rather than Fox Hills water.

In addition to the availability of alternative sources, the distance to nearby flowing-head Fox Hills wells and the quantity of water requested are taken into consideration when reviewing applications where the expected water source is the Fox Hills aquifer. An extensive Fox Hills modeling effort was undertaken to better assess hydraulic properties of the Fox Hills aquifer and to predict pressure head changes with greater confidence (Fischer 2013).

Restricting permitted water use from the Fox Hills aquifer has been primarily for industrial use. An application to supply water for temporary housing using the Fox Hills aquifer may be reviewed in a more favorable light than an application to sell water for industrial use. However, away from recharge areas the quality of water in the Fox Hills aquifer makes it unattractive as a water source for human consumption.

Policy statement

It is the policy of the Office of the State Engineer, in order to preserve a flowing pressure head in low-lying areas, to restrict industrial access to the Fox Hills-Hell Creek aquifer where other suitable sources are available. The restriction is not a moratorium on future Fox Hills water use, but takes into consideration the quantity of water needed and the proximity of flowing-head wells to the proposed water use.

References

Fischer, Kimberly (2013). *Groundwater Flow Model Inversion to Assess Water Availability in the Fox Hills-Hell Creek Aquifer* (ND Water Resource Investigation No. 54. Bismarck, ND: North Dakota State Water commission. Retrieved from swc.nd.gov/4dlink9/4dcgi/GetContentPDF/PB-2246/WRI%2054.pdf

Wanek, Alan (2009). *Recommended Decision for the City of Alexander Water Permit Application No. 5990*. Office of the State Engineer, North Dakota State Water Commission, Bismarck, ND. Retrieved from Fischer (2013), above, as Appendix D, Page 131.